

WHAT IS CLAIMED IS:

1. A method of color displacement detection for use in a color image forming apparatus that sequentially forms image layers in different colors on a photosensitive member and overlays the image layers into a color image on a transferring member, comprising:

5 forming a predetermined number of mark sets within one circumferential length surface of said transferring member, each of said predetermined number of mark sets including a predetermined number of different color marks arranged in a line in a moving direction of said transferring member;

detecting said predetermined number of mark sets formed on said transferring member; and

calculating mean values of displacement amounts of same color marks in different mark sets in said predetermined number of mark sets relative to respectively corresponding reference positions.

2. A method as defined in Claim 1, wherein said forming forms said same color marks in said different mark sets included in said predetermined number of mark sets in a pitch of three fourth circumferential length of said photosensitive member.

3. A method as defined in Claim 1, wherein said predetermined number of mark sets is eight.

4. A method as defined in Claim 1, wherein said predetermined number of mark sets is four.

20 5. A method as defined in Claim 1, wherein said predetermined number of different color marks is four.

6. A method as defined in Claim 1, wherein said different colors include magenta, cyan, yellow, and black.

25 7. A method as defined in Claim 1, further comprising:

converting a mark signal output from said detecting step into mark edge data with an A/D conversion using a predetermined pitch;

storing said mark edge data in association with respective scanning positions into a memory; and

5 generating information of mark distribution based on data groups of said mark edge data belonging to two adjacent scanning positions and to signal areas having levels with predetermined varying trends.

8. A color displacement detecting apparatus for use in a color image forming apparatus that sequentially forms image layers in different colors on a photosensitive member and overlays said image layers into a color image on a transferring member, said apparatus comprising:

a pattern generator configured to generate a test pattern including a predetermined number of mark sets within one circumferential length surface of said transferring member, each of said predetermined number of mark sets including a predetermined number of different color marks arranged in a line in a moving direction of said transferring member;

a detector configured to detect marks included in said predetermined number of mark sets;

an A/D converter configured to convert a signal output from said detector into detection data; and

20 a controller configured to control a storage operation for storing said detection data converted by said A/D converter in association with respectively corresponding scanning positions, to calculate positions of marks of said predetermined number of mark sets based on said detection data stored through said storage operation, and to calculate mean values of displacement amounts of same color marks in different mark sets in said predetermined number of mark sets relative to respectively corresponding reference positions.

9. An apparatus as defined in Claim 8, wherein said same color marks in said different mark sets included in said predetermined number of mark sets are formed in a pitch of three fourth circumferential length of said photosensitive member.

10. An apparatus as defined in Claim 8, wherein said predetermined number of

mark sets is eight.

11. An apparatus as defined in Claim 8, wherein said predetermined number of mark sets is four.

12. An apparatus as defined in Claim 8, wherein said predetermined number of 5 different color marks is four.

13. An apparatus as defined in Claim 8, wherein said different colors include magenta, cyan, yellow, and black.

14. A color displacement detecting apparatus for use in a color image forming apparatus that sequentially forms image layers in different colors on a photosensitive member and overlays said image layers into a color image on a transferring member, said apparatus comprising:

15 pattern generating means for generating a test pattern including a predetermined number of mark sets within one circumferential length surface of said transferring member, each of said predetermined number of mark sets including a predetermined number of different color marks arranged in a line in a moving direction of said transferring member;

detecting means for detecting marks included in said predetermined number of mark sets;

converting means for converting a signal output from said detecting means into detection data;

20 controlling means for controlling a storage operation for storing said detection data converted by said converting means in association with respectively corresponding scanning positions, calculating positions of marks of said predetermined number of mark sets based on said detection data stored through said storage operation, and calculating average values of displacement amounts of same color marks in different mark sets in said predetermined 25 number of mark sets relative to respectively corresponding reference positions.

15. An apparatus as defined in Claim 14, wherein said same color marks in said different mark sets included in said predetermined number of mark sets is formed in a pitch

of three fourth circumferential length of said photosensitive member.

16. An apparatus as defined in Claim 14, wherein said predetermined number of mark sets is eight.

5 17. An apparatus as defined in Claim 14, wherein said predetermined number of mark sets is four.

18. An apparatus as defined in Claim 14, wherein said predetermined number of different color marks is four.

19. An apparatus as defined in Claim 14, wherein said different colors include magenta, cyan, yellow, and black.

10 20. A method of color displacement detection for use in a color image forming apparatus that sequentially forms image layers in different colors on a photosensitive member and overlays said image layers into a color image on a transferring member, said method comprising:

15 generating a test pattern including a predetermined number of mark sets within one circumferential length surface of said transferring member, each of said predetermined number of mark sets including a predetermined number of different color marks arranged in a line in a moving direction of said transferring member;

detecting marks included in said predetermined number of mark sets;

20 converting a signal output from said detecting into detection data;

25 storing said detection data converted by said converting in association with respectively corresponding scanning positions;

calculating positions of marks of said predetermined number of mark sets based on said detection data stored through said storing; and

25 performing a calculation of average values of displacement amounts of same color marks in different mark sets in said predetermined number of mark sets relative to respectively corresponding reference positions.

21. A method as defined in Claim 20, wherein said same color marks in said different mark sets included in said predetermined number of mark sets is formed in a pitch of three fourth circumferential length of said photosensitive member.

22. A method as defined in Claim 20, wherein said predetermined number of mark sets is eight.

23. A method as defined in Claim 20, wherein said predetermined number of mark sets is four.

24. A method as defined in Claim 20, wherein said predetermined number of different color marks is four.

25. A method as defined in Claim 20, wherein said different colors include magenta, cyan, yellow, and black.

26. An image forming apparatus that sequentially forms image layers in different colors on a photosensitive member and overlays said image layers into a color image on a transferring member, said apparatus comprising:

15 an optical writing mechanism configured to write an image in accordance with image data on said transferring member; and

a color displacement detecting mechanism, comprising:

20 a pattern generator configured to generate a test pattern including a predetermined number of mark sets within one circumferential length surface of said transferring member, each of said predetermined number of mark sets including a predetermined number of different color marks arranged in a line in a moving direction of said transferring member;

a detector configured to detect marks included in said predetermined number of mark sets;

25 an A/D converter configured to convert a signal output from said detector into detection data;

a controller configured to control a storage operation for storing said detection

5 data converted by said A/D converter in association with respectively corresponding scanning positions, to calculate positions of marks of said predetermined number of mark sets based on said detection data stored through said storage operation, and to calculate mean values of displacement amounts of same color marks in different mark sets in said predetermined number of mark sets relative to respectively corresponding reference positions.

10 27. An apparatus as defined in Claim 26, wherein said same color marks in said different mark sets included in said predetermined number of mark sets is formed in a pitch of three fourth circumferential length of said photosensitive member.

15 28. An apparatus as defined in Claim 26, wherein said predetermined number of mark sets is eight.

29. An apparatus as defined in Claim 26, wherein said predetermined number of mark sets is four.

30. An apparatus as defined in Claim 26, wherein said predetermined number of different color marks is four.

31. An apparatus as defined in Claim 26, wherein said different colors include magenta, cyan, yellow, and black.

20 32. An image forming apparatus that sequentially forms image layers in different colors on a photosensitive member and overlays said image layers into a color image on a transferring member, said apparatus comprising:

optically writing means for writing an image in accordance with image data on said transferring member; and

color displacement detecting means, comprising:

25 pattern generating means for generating a test pattern including a predetermined number of mark sets within one circumferential length surface of said transferring member, each of said predetermined number of mark sets including a

predetermined number of different color marks arranged in a line in a moving direction of said transferring member;

detecting means for detecting marks included in said predetermined number of mark sets;

5           converting means for converting a signal output from said detecting means into detection data;

10           controlling means for controlling a storage operation for storing said detection data converted by said converting means in association with respectively corresponding scanning positions, calculating positions of marks of said predetermined number of mark sets based on said detection data stored through said storage operation, and calculating average values of displacement amounts of same color marks in different mark sets in said predetermined number of mark sets relative to respectively corresponding reference positions.

15           33.    An apparatus as defined in Claim 32, wherein said same color marks in said different mark sets included in said predetermined number of mark sets is formed in a pitch of three fourth circumferential length of said photosensitive member.

20           34.    An apparatus as defined in Claim 32, wherein said predetermined number of mark sets is eight.

35.    An apparatus as defined in Claim 32, wherein said predetermined number of mark sets is four.

36.    An apparatus as defined in Claim 32, wherein said predetermined number of different color marks is four.

37.    An apparatus as defined in Claim 32, wherein said different colors include magenta, cyan, yellow, and black.

25           38.    A method of image forming that sequentially forms image layers in different colors on a photosensitive member and overlays said image layers into a color image on a

transferring member, said method comprising:

providing an optical writing mechanism for writing an image in accordance with image data on said transferring member; and

executing a color displacement detection, said executing comprising:

5 generating a test pattern including a predetermined number of mark sets within one circumferential length surface of said transferring member, each of said predetermined number of mark sets including a predetermined number of different color marks arranged in a line in a moving direction of said transferring member;

detecting marks included in said predetermined number of mark sets;

10 converting a signal output from said detecting into detection data;

storing said detection data converted by said converting in association with respectively corresponding scanning positions;

calculating positions of marks of said predetermined number of mark sets based on said detection data stored through said storing; and

15 performing a calculation of average values of displacement amounts of same color marks in different mark sets in said predetermined number of mark sets relative to respectively corresponding reference positions.

39. A method as defined in Claim 38, wherein said same color marks in said different mark sets included in said predetermined number of mark sets is formed in a pitch 20 of three fourth circumferential length of said photosensitive member.

40. A method as defined in Claim 38, wherein said predetermined number of mark sets is eight.

41. A method as defined in Claim 38, wherein said predetermined number of mark sets is four.

25 42. A method as defined in Claim 38, wherein said predetermined number of different color marks is four.

43. A method as defined in Claim 38, wherein said different colors include magenta, cyan, yellow, and black.